

# PATENT SPECIFICATION



Application Date: April 24, 1923. No. 11,109/23.

218,774

Complete Accepted: July 17, 1924.

## COMPLETE SPECIFICATION.

### Improvements in Underreamers.

I, PAUL ARBON, a subject of the King of Great Britain and Ireland, of Box 111, Tulsa, Tulsa County, Oklahoma, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to underreamers for undercutting well bores of the kind wherein a body carries a plurality of cutters which are mounted in such a manner thereon so as to be capable of inward and outward movement whereby the device can be lowered through a bore or well casing with the cutters in their inner or collapsed position which are automatically forced outwardly to cutting position by suitable means when the cutters have passed below the casing.

The primary object is to provide improved means for receiving the lateral thrusts from the cutters during the cutting operation, said means being in the form of a core removably located within the body which is reversible so as to present unworn surfaces to the cutters after a portion of the core has become worn as the result of use.

A further object is to provide a draw head of novel construction for holding the cutters in active positions, this draw head being shiftable by means of a suitable key for the purpose of releasing the cutters so as to allow the cutters to be removed for sharpening or replacement.

Another object is to provide the underreamer with supplemental means for holding the cutters in proper relation to the body of the tool should any of the working parts of said tool become broken.

With the foregoing and other objects in view which will appear as the description proceeds, the invention resides in the combination and arrangement hereinafter described and claimed, it being

[Price 1/-]

understood that, within the scope of what is claimed, changes in the precise embodiment of the invention shown can be made without departing from the spirit of the invention.

In the accompanying drawings the preferred form of the invention has been shown.

In said drawings

Figure 1 is a view partly in section and partly in elevation of the under-reamer, the key used for loosening the cutters being shown in position.

Figure 2 is an enlarged section on line 2—2, Figure 1.

Figure 3 is an enlarged section on line 3—3, Figure 1.

Figure 4 is an enlarged section on line 4—4, Figure 1.

Figure 5 is an enlarged section on line 5—5, Figure 1.

Figure 6 is an enlarged section on line 6—6, Figure 1.

Referring to the figures and characters of reference 1 designates the body of the under-reamer, the same being provided at its lower end with spaced bridles 2 which connect the body to an end cage or sleeve 3. In this cage or sleeve is seated a tubular plug 4 held in place by a tangential pin 5 which can be secured by a cotter 5<sup>1</sup> or the like, as shown in Figure 2. A central bore 7 is provided in the plug for the reception of a tube 8 which constitutes a protecting sleeve or jacket for a key in the form of a rod 9. This rod has an eye 10 at its lower or outer end while its inner end is screw threaded as shown at 11 for the purpose hereinafter set forth.

The lower portion of each bridle has its inner surface at an angle to one another as shown in Figures 3 and 4 whereby a plurality of parallel guides or ways are provided. At the upper portion of each side of each bridle is a rib 12 the lower ends of which terminate at 12<sup>a</sup> substantially intermediate the upper and

lower ends of the bridles. These ribs are slidably engaged by lateral projections 13 on the sides of cutters 14, the said cutters being slidable longitudinally between the bridles and, when moved downwardly sufficient distances toward the sleeve or cage 3, being adapted to become disengaged from the ribs 12. The lower portions of the cutters are in the form of blades 15 offset outwardly as shown and the upper portion or shank of each of the cutters has its outer surface inclined upwardly and inwardly as shown at 16. Each cutter has an inwardly extending shoulder 17 at the upper end of the offset blade portion 15 and these shoulders are adapted to be engaged by outwardly extending lugs 18 formed on a draw head 19 located between the bridles 2. Notches 21 are formed in the bridles as shown in Figure 3 and are so located that when the draw head 19 is pulled downwardly from between the cutters, it can by the operator's finger or a tool be rotated to bring the lugs into the notches and thus hold the draw head from upward movement. This shifting of the draw head can be effected by means of the key 9 as herein-  
after pointed out.

The body 1 has a longitudinal bore 22 extending thereinto from its lower end and in the upper portion of this bore is mounted a sleeve 23 held against relative movement by a tangentially arranged pin 24. The sleeve has an angular opening 25 extending there-through and slidable within this opening is an elongated nut 26 engaged by the threaded upper end portion of a draw bar 27. The lower end of this draw bar has an angular head 28 seated in a correspondingly shaped recess 29 in the bottom of the draw head 19 and a threaded recess 30 is formed in the lower end of the draw bar and is adapted to receive the threaded end of the key 9.

Mounted within the body 1 is a core 31 preferably formed of hardened steel and having tapered ends 32. Cylindrical bores 33 are extended into the core from each end thereof and are connected at the center of the core by an angular passage 34. The draw bar 27 is slidably mounted in this core and has an intermediate angular portion slidable within the angular passage 34, as shown at 35 so that the draw bar is thus held against rotation. The core is prevented from rotating by a tangential pin 36 mounted in the body.

A coiled spring 37 is mounted on the draw bar and bears at one end against the lower end of the upper bore 33 and at its other end against the nut 26.

Thus the nut is held normally pressed upwardly and the spring will exert a constant pull through the draw bar 27 and the draw head 19 against the shoulders 17 on the cutters.

When it is desired to place the cutters in or remove them from position the key 9 is inserted into engagement with the draw bar 27 and is then anchored to a rigid structure after which the body 1 is pulled upwardly. This will cause the spring 37 to be placed under compression and will result in the downward movement of the draw head 19 away from the shoulders 17. The draw head 19 can then be raised by hand above the angular head 28 and rotated by hand or a suitable tool to bring the lugs 18 into the notches 21 whereupon the cutters can be slid downwardly out of engagement with the ribs 12 and thus lifted from between the bridles. The cutters after being sharpened can be replaced between the bridles or new ones can be placed in position, after which the draw head 19 can be rotated to disengage the lugs 18 from the notches 21 and thus allowed to move against the shoulders 17 and hold the cutters elevated.

When the tool is in use the key 9 and the sleeve 8 are of course removed.

To insert the apparatus in the casing the cutters are slid downwardly against the draw head 19 until the shoulders 50 are brought below the core 31 whereupon the lower ends of the cutters can swing inwardly between the bridles and thus be inserted with the body 1 into the casing of the well. After the cutters have passed beyond the lower end of the casing they will be slid upwardly and swung laterally by the spring controlled draw head and will operate efficiently for the purposes intended. During the reaming operation the hard steel core 31 constitutes a backing or abutment for the cutters and receives the thrusts therefrom. When the tool is pulled upwardly for removal from the well the cutters will remain in the same horizontal position until their shoulders 50 are clear of the lower end of the core 31 whereupon their lower ends will swing inwardly between the bridles and thus move upwardly in the casing with the body. Should one of the cutters become broken while in use or should any of the other parts break, the same will fall into the spaces between the bridles and above the cage or sleeve 3 so that by raising the tool the broken part will be elevated therewith and it will be unnecessary to fish for it.

By rotating the draw bar within the nut 26 the tension of the spring 37 can

70

75

80

85

90

95

100

105

110

115

120

125

130

be varied and by removing the pin 36 the core 31 can be removed and reversed should the lower end thereof become unduly worn as a result of its frictional engagement with the cutters.

If desired an additional spring may be provided to aid the spring 37 in holding the draw bar and draw head in the position shown in Figure 1. This additional spring may be conveniently arranged in the lower part of the body with one end bearing on the draw head and the other end against the plug 4. The cutters will thereby be held securely in place even though the draw bar or the spring 37 should break or the core 31 should work loose and thus an additional spring acts as a supplemental safety device which is very desirable although not absolutely essential.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. An underreamer of the type set forth wherein the body is of tubular form and is provided at its lower portion with guides or ways through which lateral projections or shanks of the cutters project and removably located within said body there is provided a relatively hard

core which is reversible and acts as a backing or abutment which receives the lateral thrust from the inner sides of the cutters during cutting operations.

2. An underreamer as claimed in Claim 1, wherein the upper side portions of said guides or ways are provided with retaining ribs which are slidably engaged by lateral projections on the lateral projections or shanks of the cutters and said core is tubular in form and has located therein means carrying a part engaging the cutters, which is under the influence of spring means for normally holding the cutters with their upper faces in engagement with the upper faces of the guides.

3. An underreamer as claimed in Claim 1, wherein there is provided a draw bar in the body having a head engaging the cutters and resilient means whereby the cutters are normally held in cutting position and said head and the body are provided with co-operating means for holding the draw bar against return to normal position with the cutters in released position.

4. The improved underreamer substantially as described with reference to the accompanying drawings.

Dated this 24th day of April, 1923.

MARKS & CLERK.

[This Drawing is a reproduction of the Original on a reduced scale]

